CLAIMS:

What is claimed is:

1. A laser energy microinscribing system, comprising:

a pulse laser energy source;

a workpiece mounting system, allowing optical access to a mounted workpiece;

an optical system for focusing laser energy from the laser energy source, onto the workpiece;

means for directing said focused laser energy onto a desired portion of the workpiece, having a control input;

an imaging system for viewing the workpiece from a plurality of vantage points;

an input for receiving marking instructions;

a processor for controlling said directing means based on said marking instructions and said imaging system, to selectively generate a marking based on said instructions and a predetermined program; and

a storage system for storing information relating to images of a plurality of workpieces.

2. The laser energy microinscribing system according to claim 1, wherein said pulse laser energy source comprises a semiconductor diode excited Q-switched neodynium laser.

3. The laser energy microinscribing system according to claim 2, wherein said laser is a Nd:YLF laser with an internal harmonic converter having an output at 530 nm.

4. The laser energy microinscribing system according to claim 1, further comprising a power supply for said pulse laser energy source.

5. The laser energy microinscribing system according to claim 1, further comprising a chassis for rigidly supporting said pulse laser energy source, said workpiece mounting system, said optical system, and said directing means.

6. The laser energy microinscribing system according to claim 1, further comprising a power supply for said pulse laser energy source and a chassis for rigidly supporting said pulse laser energy source, said workpiece mounting system, said optical system, said directing means and said power supply.

7. The laser energy microinscribing system according to claim 1, further comprising a chassis for rigidly supporting said pulse laser energy source, said workpiece mounting system, said optical system, and said directing means, said directing means repositioning the workpiece with respect to said chassis.

8. The laser energy microinscribing system according to claim 1, wherein said workpiece mounting system comprises a fixed member, detachable member and a mounting clamp for fixing the workpiece to said detachable member.

9. The laser energy microinscribing system according to claim 1, wherein the workpiece is a gemstone.

10. The laser energy microinscribing system according to claim 1, wherein the workpiece is a cut diamond.

11. The laser energy microinscribing system according to claim 1, wherein said optical system comprises a beam expander, a dichroic mirror and a focusing lens.

12. The laser energy microinscribing system according to claim 1, wherein said directing means comprises a translatable stage having at least three axes of movement.

13. The laser energy microinscribing system according to claim 1, wherein said directing means is controlled to produce a set of partially overlapping irradiated areas from said pulse laser energy source.

14. The laser energy microinscribing system according to claim 1, wherein said directing means is controlled to produce a set of continuous shapes formed of partially overlapping irradiated areas from said pulse laser energy source.

15. The laser energy microinscribing system according to claim 1, wherein said directing means is controlled to be at rest during a laser pulse of said pulse laser energy source.

16. The laser energy microinscribing system according to claim 1, wherein said imaging system comprises an optical path including at least a portion of the workpiece and being

coaxial with at least a portion of an axis of a laser pulse of said pulse laser energy source incident on the workpiece.

17. The laser energy microinscribing system according to claim 1, wherein said imaging system comprises an optical path including at least a portion of the workpiece and being perpendicular to at least a portion of an axis of a laser pulse of said pulse laser energy source incident on the workpiece.

18. The laser energy microinscribing system according to claim 1, wherein said imaging system comprises a first optical path including at least a portion of the workpiece and being coaxial with at least a portion of an axis of a laser pulse of said pulse laser energy source incident on the workpiece and a second optical path including said portion of the workpiece and being perpendicular to said axis of said laser pulse.

19. The laser energy microinscribing system according to claim 1, wherein said imaging system comprises an electronic imaging device for transmitting image information to said processor, said processor controlling said directing means further based on said image information.

20. The laser energy microinscribing system according to claim 1, wherein said imaging system images a portion of the workpiece on which an output of said pulse laser energy source is incident through a dichroic mirror.

21. The laser energy microinscribing system according to claim 1, wherein said input for receiving marking instructions comprises a bar code reader.

22. The laser energy microinscribing system according to claim 1, wherein said input for receiving marking instructions comprises an optical image transducer.

23. The laser energy microinscribing system according to claim 1, wherein said input for receiving marking instructions comprises an input for receiving information relating to a quality of the workpiece.

24. The laser energy microinscribing system according to claim 1, wherein said input for receiving marking instructions comprises an sensor for automatically determining a characteristic of the workpiece.

25. The laser energy microinscribing system according to claim 1, further comprising a telecommunications link, wherein said storage system comprises a remote electronic database.

26. The laser energy microinscribing system according to claim 1, wherein said storage system receives image information for storage from said imaging system.

27. The laser energy microinscribing system according to claim 1, wherein said storage system stores information relating to images of workpieces in conjunction with information relating to said marking instructions.

28. The laser energy microinscribing system according to claim 1, further comprising an input for receiving information relating to an image of a workpiece and means for comparing to determine a relation between said information relating to the workpiece and said stored information.

29. The laser energy microinscribing system according to claim 28, further comprising an output indicative of a relation between the workpiece and said stored information.

30. The laser energy microinscribing system according to claim 28, wherein said input receives information from said imaging system.

31. The laser energy microinscribing system according to claim 1, receiving information from said imaging system relating to an image of the workpiece, further comprising means for comparing said received information and said marking instructions with said stored information, to determine a correspondence of the workpiece marked in accordance with said marking instructions with any stored information.

32. The laser energy microinscribing system according to claim 1, further comprising means for comparing said marking instructions with said stored information, to determine a correspondence of a resulting workpiece marked in accordance with said marking instructions with any stored information.

33. The laser energy microinscribing system according to claim 1, wherein said processor analyzes said marking instructions and said stored information and selectively controls said directing means based on said analysis.

34. A method of microinscribing a workpiece with laser energy from a pulse laser energy source, focused by an optical system on the workpiece, comprising the steps of:

mounting a workpiece in a mounting system;

directing the focused laser energy onto a desired portion of the workpiece;

imaging the workpiece from a plurality of vantage points;

receiving marking instructions as at least one input,

controlling the directing of the focused laser energy based on the marking instructions and the imaging, to selectively generate a marking based on said instructions; and

storing information relating to images of a plurality of workpieces.

35. The method according to claim 34, wherein the pulse laser energy source comprises a semiconductor diode excited Q-switched neodynium laser.

36. The method according to claim 35, wherein the laser is a Nd:YLF laser having a internal harmonic converter and an output of about 530 nm.

37 The method according to claim 34, wherein the system further comprises a chassis for rigidly supporting the pulse laser energy source, the mounting system, the optical system, and

a focused laser energy directing system, further comprising the step of repositioning the workpiece with respect to the chassis.

38. The method according to claim 34, wherein the mounting system comprises a fixed member, a detachable member and a mounting clamp for fixing the workpiece to the detachable member, further comprising the step of rigidly linking the detachable member to the fixed member.

39. The method according to claim 34, wherein the workpiece is a gemstone.

40. The method according to claim 34, wherein the workpiece is a cut diamond.

41. The method according to claim 34, wherein the optical system comprises a beam expander, a dichroic mirror and a focusing lens, further comprising the step of expanding an output of the pulse laser energy source with the beam expander, selectively reflecting at least a portion of the expanded beam with the dichroic mirror, and focusing the reflected expanded beam on the workpiece with the focusing lens.

42. The method according to claim 34, wherein the optical system comprises a beam expander, a dichroic mirror and a focusing lens, further comprising the step of expanding an output of the pulse laser energy source with the beam expander, selectively reflecting at least a portion of the expanded beam with the dichroic mirror, focusing the reflected expanded beam on the workpiece with the focusing lens and electronically imaging the workpiece through the dichroic mirror.

43. The method according to claim 34, further comprising the step of electronically imaging a portion of the workpiece on which an output of the pulse laser energy source is incident through a dichroic mirror.

44. The method according to claim 34, wherein said controlling the directing step comprises controlling movement of a translatable stage along at least three axes.

45. The method according to claim 34, wherein said controlling the directing step comprises generating a set of partially overlapping irradiated areas from the pulse laser energy source.

46. The method according to claim 34, further comprising the step of fixing a position of the workpiece with respect to a focal point of the pulse laser energy source during a laser pulse.

47. The method according to claim 34, wherein said imaging step comprises imaging through an optical path including at least a portion of the workpiece and being coaxial with at least a portion of an axis of a laser pulse of the pulse laser energy source incident on the workpiece.

48. The method according to claim 34, wherein said imaging step comprises imaging through an optical path including at least a portion of the workpiece and being perpendicular to at

least a portion of an axis of a laser pulse of the pulse laser energy source incident on the workpiece.

49. The method according to claim 34, wherein said imaging step comprises imaging through a first optical path including at least a portion of the workpiece and being coaxial with at least a portion of an axis of a laser pulse of said pulse laser energy source incident on said workpiece and a second optical path including said portion of the workpiece and being perpendicular to said axis of said laser pulse.

50. The method according to claim 34, further comprising the steps of transmitting electronic image information to said processor, and controlling the directing further based on the image information.

51. The method according to claim 34, further comprising the step of receiving marking instructions from a bar code reader.

52. The method according to claim 34, further comprising the step of receiving marking instructions from an optical image transducer.

53. The method according to claim 34, further comprising the step of marking the workpiece with information relating to a quality of the workpiece.

54. The method according to claim 34, further comprising the steps of automatically determining a characteristic of the workpiece and using the determined characteristic for marking instructions.

55. The method according to claim 34, further comprising the step of communicating information relating to images through a telecommunications link and storing the information in a remote electronic storage database.

56. The method according to claim 34, further comprising the step of deriving the stored information from the imaging.

57. The method according to claim 34, further comprising the step of storing information relating to images of workpieces in conjunction with information relating to the marking instructions.

58. The method according to claim 34, further comprising the steps of receiving information relating to an image and determining a relation between the workpiece and the stored information.

59. The method according to claim 34, further comprising the steps of receiving information relating to an image of a workpiece, and producing an output indicative of a relation between the workpiece and said stored information.

60. The method according to claim 34, further comprising the step of comparing images received during said imaging step with previously stored information.

61. The method according to claim 34, further comprising the steps of receiving information relating to an image of the workpiece, comparing the received information and the marking instructions with previously stored information, to determine a correspondence of the workpiece marked in accordance with the marking instructions with any stored information.

62. The method according to claim 34, further comprising the steps of comparing the marking instructions with previously stored information, to determine a correspondence of a resulting workpiece marked in accordance with the marking instructions with any stored information.

63. The method according to claim 34, further comprising the steps of analyzing the marking instructions and previously stored information and selectively controlling the marking based on said analysis.

65. The method according to claim 34, wherein said marking comprises a set of lines or spots.

65. A workpiece microinscribed by the method of claim 34.

66. A diamond marked in accordance with the method of claim 34.

67. The method according to claim 34, wherein at least one received input comprises encrypted information.

68. The method according to claim 34, further comprising the steps of extracting information from an image of the workpiece, encrypting the extracted information, and providing the encrypted information as a received input.

69. The method according to claim 34, further comprising the steps of determining a characteristic of the workpiece, encrypting an expression of the determined characteristic of the workpiece using a public key-private key encryption algorithm, and providing the encrypted expression as a received input.

70. The method according to claim 69, further comprising the steps of decrypting the marking using a public key and comparing the decrypted expression with a characteristic of the workpiece, to authenticate the marking.

71. The method according to claim 34, further comprising the steps of:

determining a characteristic of the workpiece;

encrypting an expression of the determined characteristic of the workpiece;

providing the encrypted expression as a received input;

storing information relating to the characteristic; and

authenticating the workpiece based on a description of the marking on a workpiece and a determined characteristic of the workpiece.

72. The method according to claim 34, further comprising the steps of identifying a landmark of the workpiece from images obtained during the imaging step; microinscribing a marking at a position based on a position of the identified landmark; and storing the position.

73. A laser energy microinscribing system, comprising:

a semiconductor excited Q-switched solid state laser energy source;

a cut gemstone mounting system, allowing optical access to a mounted workpiece;

an optical system for focusing laser energy from the laser energy source onto a cut gemstone;

a displaceable stage for moving said gemstone mounting system with respect to said optical system so that said focused laser energy is presented to desired positions on said gemstone, having a control input;

an imaging system for viewing the gemstone from a plurality of vantage points; and

a rigid frame supporting said laser, said optical system and said stage in fixed relation, to resist differential movements of said laser, said optical system and said stage and increase immunity to vibrational misalignments.

74. The laser energy microinscribing system according to claim 73, wherein said laser energy source comprises a semiconductor diode excited Q-switched Nd:YLF laser with a harmonic converter having an output of about 530nm.

75. The laser energy microinscribing system, according to claim 73, further comprising:

an input for receiving marking instructions;

a processor for controlling said displaceable stage based on said marking instructions and said imaging system, to selectively generate a marking based on said instructions and a predetermined program; and

a storage system for electronically storing information relating to images of a plurality of workpieces.

76. The laser energy microinscribing system according to claim 73, further comprising a power supply for said pulse laser energy source.

77. The laser energy microinscribing system according to claim 73, further comprising a chassis for rigidly supporting said laser energy source, said workpiece mounting system, said optical system, and said translatable stage.

78. The laser energy microinscribing system according to claim 73, further comprising a power supply for said laser energy source and a chassis for rigidly supporting said laser energy source, said workpiece mounting system, said optical system, said translatable stage and said power supply.

79. The laser energy microinscribing system according to claim 73, further comprising a chassis for rigidly supporting said laser energy source, said workpiece mounting system, said

optical system, and said translatable stage, said translatable stage repositioning the workpiece with respect to said chassis.

80. The laser energy microinscribing system according to claim 73, wherein said workpiece mounting system comprises a fixed member, detachable member and a mounting clamp for fixing the workpiece to said detachable member.

81. The laser energy microinscribing system according to claim 73, wherein the workpiece is a gemstone.

82. The laser energy microinscribing system according to claim 73, wherein the workpiece is a cut diamond.

83. The laser energy microinscribing system according to claim 73, wherein said optical system comprises a beam expander, a dichroic mirror and a focusing lens.

84. The laser energy microinscribing system according to claim 73, wherein said translatable stage has at least three axes of movement.

85. The laser energy microinscribing system according to claim 73, wherein said translatable stage is controlled to produce a set of partially overlapping irradiated areas from said laser energy source.

86. The laser energy microinscribing system according to claim 73, wherein said translatable stage is controlled to be at rest during a laser pulse of said laser energy source.

87. The laser energy microinscribing system according to claim 73, wherein said imaging system comprises an optical path including at least a portion of the workpiece and being coaxial with at least a portion of an axis of a laser pulse of said laser energy source incident on the workpiece.

88. The laser energy microinscribing system according to claim 73, wherein said imaging system comprises an optical path including at least a portion of the workpiece and being perpendicular to at least a portion of an axis of a laser pulse of said laser energy source incident on the workpiece.

89. The laser energy microinscribing system according to claim 73, wherein said imaging system comprises a first optical path including at least a portion of the workpiece and being coaxial with at least a portion of an axis of a laser pulse of said laser energy source incident on the workpiece and a second optical path including said portion of the workpiece and being perpendicular to said axis of said laser pulse.

90. The laser energy microinscribing system according to claim 73, wherein said imaging system images a portion of the workpiece on which an output of said laser energy source is incident, through a dichroic mirror.

91. The laser energy microinscribing system according to claim 73, further comprising means for automatically determining a characteristic of the workpiece.

92. A method of authenticating a marking on a workpiece, comprising the steps of:

marking the workpiece with a high precision focused laser energy ablation pattern;

storing an image of the workpiece, including details of at least a portion of the ablation pattern; and

producing information of the stored image on a secure certificate.

93. The method according to claim 92, wherein said secure certificate includes self-authenticating encrypted information.

94. The method according to claim 92, wherein the marked workpiece is packaged in conjunction with the secure certificate.

95. The method according to claim 92, further comprising the step of imprinting a security code on said secure certificate.

96. The method according to claim 92, wherein the image is photographic.

97. The method according to claim 92, wherein the image is electronically formed.

98. A secure certificate comprising:

a secure document having tamper evident features; and

an image of a high precision focused laser energy ablation pattern of a workpiece on said secure document

99. The secure certificate according to claim 98, wherein said image is photographic.

100. The secure certificate according to claim 98, wherein said image is electronic.

101. The secure certificate according to claim 98, further comprising a security code formed on said secure document.